HHS Public Access
Author manuscript
J Health Psychol. Author manuscript; available in PMC 2022 August 01.

Published in final edited form as:
J Health Psychol. 2021 August ; 26(9): 1455–1467. doi:10.1177/1359105319877448.

Validation of the Pittsburgh Fatigability Scale in a mixed sample of adults with and without chronic conditions

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Abstract

The aim of this study was to validate the Pittsburgh Fatigability Scale in three different groups: adults with multiple sclerosis ($n = 65$), fibromyalgia ($n = 64$), and healthy adults ($n = 86$). Participants completed the Pittsburgh Fatigability Scale and other self-report measures. While findings supported the internal consistency of the Pittsburgh Fatigability Scale (all Cronbach's alpha ⩾ 0.85), standard error of measurement estimates were larger than hypothesized. In addition, while item-level reliability was generally supported, item-total correlations for two items were lower than expected. Convergent and discriminant validity were supported, and the Pittsburgh Fatigability Scale was able to distinguish between individuals with and without chronic disease. Overall, the Pittsburgh Fatigability Scale exhibited acceptable psychometric properties.

Keywords

fatigability; fatigue; fibromyalgia; multiple sclerosis; validation

Fatigue can have a negative impact on the health-related quality of life (HRQOL), functional ability, and mortality of older adults and those with chronic medical conditions (Amato et al., 2001; Avlund et al., 2001; Bakshi et al., 2000; Fishbain et al., 2003; Humphrey et al., 2010; Janardhan and Bakshi, 2002; Kroencke et al., 2000; Krupp et al., 1988; Vestergaard et al., 2009). In fact, fatigue is one of the highest ranked problems for persons with fibromyalgia (FM) (Bennett et al., 2007; Mease et al., 2008; Wolfe et al., 1995a, 1995b) and multiple sclerosis (MS) (Finlayson et al., 1998; Fisk et al., 1994; Freal et al., 1984; Krupp et al., 1988; Merkelbach et al., 2002; Yorkston et al., 2012). Although there is an extensive body of research examining fatigue across different clinical conditions, a newer concept, "fatigability," (Eldadah, 2010; Murphy and Schepens Niemiec, 2014) has gained influence in the literature. This concept, which encompasses perceived fatigue in the context of

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Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

performance, such as one's usual activities (Murphy et al., 2017), was developed to help explain discrepant findings in the broader fatigue literature. Findings regarding the relationship between fatigue and age are mixed: some studies report that fatigue increases with age (Beutel et al., 2002, 2004; Cheng et al., 2008), some report no association (Hickie et al., 1996; Liao and Ferrell, 2000), and still others report that fatigue decreases with age (Bardel et al., 2009; Fuhrer and Wessely, 1995; Junghaenel et al., 2011; Lerdal et al., 2005; Stone et al., 2008). The concept of perceived fatigability (or the association of perceived fatigue and level of activity) could provide a potential explanation for these disparate findings (Eldadah, 2010). When the activity level is taken into account in the fatigue experience, a better understanding of how fatigue impacts daily function emerges. For example, two older adults may report a similar high fatigue severity but have very different levels of fatigability. One older adult may have a high level of fatigue despite doing limited physical activity, while another older adult may report the same level of fatigue but participate in many activities. Thus, understanding a person's fatigability level is important for identifying who may benefit from treatment and specific areas to address. As such, a better understanding of fatigability can help guide the timing and selection of therapies designed to target fatigue in clinical practice.

Recently, a patient-reported outcome (PRO) measure of perceived fatigability, the Pittsburgh Fatigability Scale (PFS) (Glynn et al., 2015), was developed to assess this construct in older adults. The PFS consists of two subscales, Physical Fatigability and Mental Fatigability, which measure perceptions of physical and mental fatigue relative to participation in different activities. Initial development work for this 10-item scale indicates good psychometric properties in older adults (i.e. adults aged 60 years and older), very good internal consistency reliability (Cronbach's alpha = 0.88), and very good test–retest reliability (intraclass correlation = 0.86). Known group validity is also supported for the Physical Fatigability subscale (significant differences in scores between those with high vs low performance fatigability, slow vs normal gait speed, worse vs better physical function, and lower vs higher levels of fitness). However, while this developmental work is promising, it is incomplete. First, reliability data (internal consistency and test–retest) are reported only for the full 10-item scale (presumably a "total score"), even though the final recommendations indicate that the PFS yields two separate scores with no mention of calculating a total score. Second, known group validity was only examined for the Physical Fatigability score. In addition, prior development work has focused solely on older adults with no psychometric data to support or refute the clinical utility of this measure in chronic conditions where high levels of fatigability are common (Dobkin, 2008; Finsterer and Mahjoub, 2014; Kluger et al., 2013; Sandvig et al., 2015). Moreover, published data regarding the PFS in independent samples (i.e. outside the initial development work) are scarce. To our knowledge, only two other studies have examined this measure. The first study focused on the validation of a Spanish version of this measure (Perez et al., 2018), while the second study (in older adults) found that older adult women reported greater fatigability than older adult men and that body mass index and interleukin-6 were associated with fatigability (Cooper et al., 2018). While these limited data would indicate that the PFS may be a clinically useful tool, data are not yet available to support its utility in specific clinical populations.

This report aims to provide more robust examination of the psychometric properties of the PFS across three different populations that commonly experience fatigue: adults from the healthy aging population (healthy adults) and adults with MS or FM. A second objective is to characterize fatigability in these different populations. In order to establish the clinical utility of the PFS in adults with MS, FM, and healthy adults, we examined floor and ceiling effects, internal consistency reliability, convergent and discriminant validity, and known group validity for persons in these groups.

Methods

Participants

Participants with a physician-confirmed MS (based on medical record review), FM confirmed using the Fibromyalgia Survey Questionnaire (Wolfe et al., 2011) according to the 2016 American College of Rheumatology criteria (Wolfe et al., 2016), and adult participants designed to represent a healthy aging group were recruited for participation in this study. A designated study coordinator contacted eligible participants and invited them to participate. Study participants had to be ⩾18 years of age and able to read and speak English. Study participants were excluded if they reported an illness within the past 2 weeks. Participants with MS were excluded if they reported an MS relapse within 30 days of screening. Recruitment included multiple existing research registries, a university-based recruitment website (www.UMHealthresearch.org), and community outreach. All study procedures and data collection occurred with approval from and in accordance with local institutional review board (IRB) guidelines. Informed consent was obtained from all participants.

Pittsburgh Fatigability Scale

The PFS (Glynn et al., 2015) was developed to measure the physical and mental fatigue that a participant feels or would expect to after doing a particular activity. Each item is answered with regard to physical fatigue and mental fatigue regardless of whether the participant actually participates in that activity. Both the Physical Fatigability and Mental Fatigability scores range from 0 to 50, with higher scores indicating more fatigue.

Patient-Reported Outcomes Measurement Information System

For the current study, the Patient-Reported Outcomes Measurement Information System (PROMIS; Cella et al., 2007, 2010; Gershon et al., 2010) Fatigue$_{FM}$ Profile short form (Kratz et al., 2016), which consists of four subdomains including Fatigue Experience, Social Impact, Motivational Impact, and Cognitive Impact; PROMIS Cognitive Function, which measures self-reported thinking and memory ability; PROMIS Physical Function, which measures capability of performing activities that require the use of upper and lower extremities; and PROMIS Sleep Disturbance, which measures perceptions of sleep quality, were administered (Cella et al., 2007, 2010; Gershon et al., 2010). PROMIS scores are on a Tmetric with a mean of 50 (standard deviation (*SD*) = 10), with higher scores indicating more of the associated construct (higher scores for positively worded concepts indicate better function—better physical or cognitive function, whereas higher scores for negatively worded constructs indicate worse function—worse fatigue or sleep disturbance). These measures were administered to assess convergent/ discriminant validity of the PFS domains.

Fatigue Severity Scale

The Fatigue Severity Scale (FSS; Krupp et al., 1989) is a self-report measure of fatigue. FSS scores range from 9 to 63; higher scores indicate more fatigue (Krupp et al., 1989). This measure was used to determine the convergent validity of the PFS domains.

Epworth Sleepiness Scale

The Epworth Sleepiness Scale (ESS; Johns, 1991) assesses feelings of daytime sleepiness. Scores range from 0 to 24, with scores of 0–10 indicating normal daytime sleepiness, 11–12 indicating mild excessive daytime sleepiness, 13–15 indicating moderate excessive daytime sleepiness, and ⩾16 indicating severe excessive sleepiness (Johns, 1991). This measure was used to determine the discriminant validity of the PFS domains.

Generalized Anxiety Disorder 7-item Scale

The Generalized Anxiety Disorder 7-item scale (GAD-7; Spitzer et al., 2006) measures general feelings of anxiety over the past 2 weeks. Scores range from 0 to 21, with scores between 5 and 9 indicating mild anxiety, 10 and 14 indicating moderate anxiety, and ⩾15 indicating severe anxiety (Spitzer et al., 2006). This measure was used to determine the discriminant validity of the PFS domains.

Personal Health Questionnaire Depression Scale

The Personal Health Questionnaire Depression Scale (PHQ-8; Kroenke et al., 2009) is used to measure depressed mood over the past 2 weeks. Scores range from 0 to 24, with scores greater than 10 indicating moderate levels of depression and scores ⩾20 indicating severe levels of depression (Kroenke et al., 2009). This measure was used to determine the discriminant validity of the PFS domains.

Study procedures

Self-report surveys were administered using a web-based platform: REDCap (Research Electronic Data Capture; Harris et al., 2009).

Compliance with ethical standards

All data were collected in accordance with and approval of the University of Michigan Institutional Review Board; participants provided informed consent prior to study participation.

Statistical analyses

For each of the three groups (i.e. MS, FM, and healthy adults), demographics were compared using analysis of variance (ANOVA) or chi-square (Fisher's exact test (Fisher, 1922) when expected cell counts < 5) analysis.

Cronbach's alpha coefficients were also calculated to determine internal consistency of the PFS (minimal acceptable criteria > 0.70 (Cronbach, 1951)) for both the overall sample as well as within each group. From the Cronbach's alpha coefficient, standard error of measurement (SEM), or the amount of variance between one's predicted score, and their true score were calculated using the formula: (Cohen and Swerdlik, 2010; Tavakol and Dennick, 2011; Weir, 2005).

SEMs are presented in percentages (SEM divided by the mean of all observations × 100) for easier interpretability (Flansbjer et al., 2005). SEM percentages less than 10 percent indicate good reliability (Flansbjer et al., 2005; Liaw et al., 2008). Floor and ceiling effects, defined as percent of participants who answered either 0 (no fatigue) or 5 (extreme fatigue) for all 10 items, were calculated (minimum acceptable criteria ⩽ 20%) (Andresen, 2000; Cramer and Howitt, 2004). For item-level reliability, item-total (i.e. item-sub-scale score) correlations should be ⩾0.70 (Cronbach, 1951). Item-level reliability for Cronbach's alpha using the "if item were deleted" method should be less than or equal to the domain score after an item is deleted (Yu, 2001).

To support convergent and discriminant validity, Pearson correlation coefficients between the PFS and other comparator domains were calculated. Correlations between the PFS and similar constructs (i.e. fatigue) should be high (0.60–0.80) but should not exceed 0.80 (which would be indicative of too much overlap (Campbell and Fiske, 1959)). Correlations between the PFS and other domains should be small to moderate (i.e. 0.30–0.59) (Campbell and Fiske, 1959).

Known group validity was assessed by comparing PFS Physical and Mental Scores between the FM, MS, and healthy aging groups using one-way ANOVA. As participant gender and age were expected to affect fatigability (Beutel et al., 2002, 2004; Cheng et al., 2008; Cooper et al., 2018), these variables were added to each model as covariates. Least-squared means and standard errors were calculated for each of the groups and compared using Bonferroni post hoc analyses. We expected the MS and FM groups to have more mental and physical fatigue than the healthy aging group. Partial eta-squared effect sizes (ηp^2) were calculated to determine the amount of variance in fatigability explained by group differences; ηp^2 sizes of 0.01 were considered small, 0.06 was considered moderate, and 0.14 was considered large (Cohen, 1969).

Results

Two-hundred fifteen individuals with MS ($n = 65$), FM ($n = 64$), and a group of healthy adults ($n = 86$) completed study measures (Table 1). The average age of the sample was 53.6 years ($SD = 16.4$); approximately 81.2 percent were White and 93 percent were identified as non-Hispanic/Latino. For the FM and MS groups, the average time since diagnosis was 12.7 years ($SD = 9.2$). There were differences between the three groups with regard to gender; the group of healthy adults had a greater proportion of males (32.6%) than either the FM group (10.9%) or the MS group (15.4%; $\chi^2 = 12.1$; $p = 0.0024$). There were significant differences with regard to education; the FM group had fewer participants who were college/ professional school graduates (Fisher's exact test $p = 0.04$). Furthermore, the MS group had a higher proportion of married individuals and fewer single, never married participants than the other two groups (Fisher's exact test $p = 0.0025$). In addition, the FM group had a higher number of comorbid conditions ($M = 2.3$; $SD = 1.7$) than those with MS ($M = 1.1$; $SD = 1.5$) or healthy adults ($M = 1.1$; $SD = 1.3$; $F(2, 212) = 13.6$; $p < 0.0001$).

Internal consistency was good for both Physical and Mental Fatigability scores for all three groups and the full sample (minimum $\alpha = 0.85$; Table 2). However, SEM measures of reliability generally did not meet acceptable levels; the single exception was the SEM for PFS Physical Fatigability for the FM group ($SEM\% = 9.5$). This indicates that for the PFS Physical Fatigability Scale, one can expect a participant's true score to fall within 9.5 percent difference of their observed score. Both measures were absent of floor and ceiling effects across the three groups and for the full sample.

Item-level reliability was generally acceptable (Table 3). Notable exceptions for item-total correlations were "Watching TV for 2 hours" and "Sitting quietly for 1 hour" for both the Mental and Physical Fatigability scores. In addition, "Hosting a social event for 1 hour (not including preparation time)" also did not meet the cutoff for item-total correlations for the Mental Fatigability score. In addition, two items were just below the cutoff for the item-total correlations (i.e. reliability was 0.69 for both): "High-intensity activity for 30 minutes (jogging, hiking, biking, swimming, racquet sports, aerobic machines, dancing, Zumba)" was below the cutoff for the Physical Fatigability score and "Participating in a social activity for 1 hour (party, dinner, senior center, gathering with family/friends, playing cards, bridge)" was below the cutoff for the Mental Fatigability score. Cronbach's alpha according to the "if item were deleted" method was generally acceptable except for "Watching TV for 2 hours" and "Sitting quietly for 1 hour" for both scores.

In general, convergent validity was acceptable for the PFS Physical and Mental Fatigability scores (Table 4). Both PFS scores exhibited moderate to strong correlations with fatigue and physical function domains; however, the PFS Physical Fatigability score showed some potential redundancy ($r > 0.80$) with PROMIS Fatigue and PROMIS Physical Function. Discriminant validity of both Fatigability scores was supported by small to moderate correlations with cognitive function, sleep, anxiety, and depression.

Known group validity was supported for both PFS scores (Table 5 and Figure 1). There were significant differences between the three groups with regard to PFS Physical and Mental Fatigability scores. For both Physical and Mental scores, the FM and MS groups each had significantly higher scores than the healthy adult group, with large partial eta-squared effect sizes for Physical ($\eta^2 = 0.44$) and Mental ($\eta^2 = 0.27$) scores.

Discussion

This study examined the reliability and validity of the PFS in persons with two distinct chronic conditions (FM and MS) and a group of healthy adults who were somewhat younger than the initial development sample (Glynn et al., 2015). Internal consistency for the different fatigability scores was excellent for the combined sample and good for each of the subgroups (FM, MS, and healthy adults), providing support for reliability. Yet, the amount of variance between the predicted score and the true score generally exceeded a priori criterion for all individual groups, as well as the combined sample (the exception was that the Physical Fatigability score met the criterion for the FM group), suggesting a potential area of concern with regard to reliability. Regardless, the PFS was devoid of floor and ceiling effects.

An examination of item-level reliability suggested that the majority of the items were performing as expected within the scale. Two items, “Watching TV for 2 hours” and “Sitting quietly for 1 hour” did not appear to be strongly related to either the Physical or the Mental Fatigability domains, and when these items were removed from each score, the reliability of the overall measure improved, suggesting that these two items are not providing reliable information about physical or mental fatigability. As such, these items are candidates for exclusion from future versions of this scale, and users of this scale might consider generating raw scores for each of these subdomains that do not include these items.

In general, convergent and discriminant validity of the PFS Physical and Mental Fatigability scores was acceptable. First, there were moderate to strong correlations with other measures of fatigue and physical function which was expected (supporting convergent validity). Yet, the pattern of correlations was not always what was expected. For example, it was surprising to see a stronger correlation between physical fatigability and cognitive fatigue (i.e. 0.64 for correlation between PFS Physical Fatigability score and Fatigue Cognitive Impact), than between mental fatigability and cognitive fatigue (i.e. 0.40 between PFS Mental Fatigability Score and Fatigue Cognitive Impact). In addition, the strong correlations between physical fatigability (i.e. the PFS Physical Fatigability score) and physical function (PROMIS Physical Function) suggest a level of redundancy that was not expected, given that these are related, but separate constructs. Regardless, discriminant validity for both PFS scores was supported by small to moderate correlations with measures of sleep, anxiety, and depression. Finally, known group validity of the PFS was supported, in that those individuals with chronic conditions reported higher levels of physical and mental fatigability than individuals in the health adults group. This finding is consistent with research that has supports that persons with chronic conditions exhibit high levels of fatigability (Dobkin, 2008; Finsterer and Mahjoub, 2014; Kluger et al., 2013; Sandvig et al., 2015). Taken together, while findings are generally favorable and support the validity of the PFS, it is likely that the items that are exhibiting poor reliability are likely having a negative impact on the psychometric validity of the scale. More work is needed to determine if, with some minor adjustments, such as the removal of these two potentially problematic items, the psychometric properties of the PFS might be improved.

Study limitations

While this study establishes important reliability and validity data for the PFS, it is also important to recognize several study limitations. First, this study relies solely on self-report data and did not include any objective assessments of activity in the context of fatigue. Future research should focus on understanding how this PRO data relate to objective measures of fatigability and/or physical activity. In addition, respondents were primarily Caucasian, women, and persons who were highly educated; thus, generalizability is somewhat limited with regard to racial/ethnic minorities, males, and persons with less educational attainment. Furthermore, we did not match study participants in the different groups; thus, differences in age, sex, and/or ethnicity may contribute to findings. The study was also not designed to account for disease-specific characteristics that could impose within-participant variability within a condition (i.e. disability level in MS).

Conclusion

The PFS generally demonstrates acceptable psychometric reliability and validity which would support its clinical utility in persons with FM and MS, as well as in healthy adults. Furthermore, the PFS is able to differentiate between individuals with FM and/or MS from healthy adults. Additional work is still needed to examine test–retest reliability, as well as change over time. In summary, this PRO provides an appropriate tool for assessing fatigability in persons who may be at high risk for fatigue. Ultimately, this type of PRO could be used to guide the timing and selection of therapeutic strategies to treat fatigue in clinical practice or inform the timing of other important therapeutic interventions such as exercise or physical therapy.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Research reported in this publication was supported by the National Institute on Aging of the National Institutes of Health under award number R21AG053186; principal investigator: A.L.K. A.L.K. was supported during manuscript preparation by a grant from the National Institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institutes of Health (award number K01AR064275). The U-M Pepper Center, which is funded by the National Institute of Aging (award number AG024824), provided assistance with participant recruitment. The Michigan Institute for Clinical & Health Research (MICHR: NIH award number UL1TR002240) provided data collection support through REDCap. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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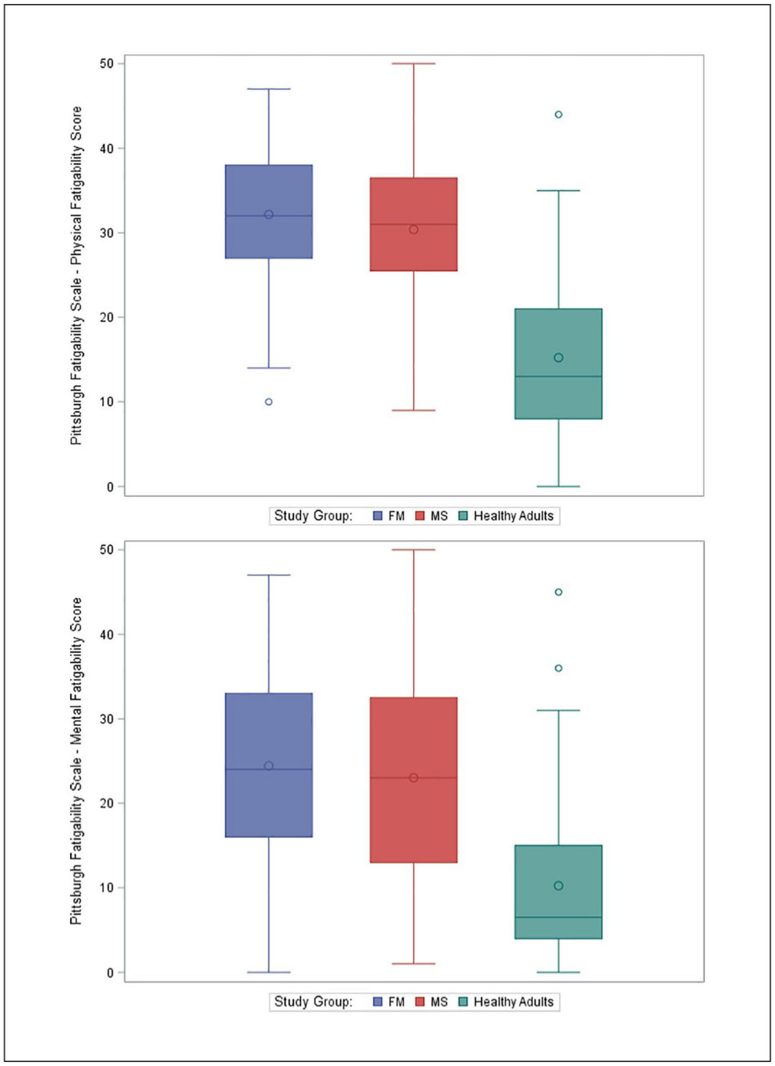

Figure 1.

Average scores for the Pittsburgh Fatigability Scale Physical and Mental domains.

Table 1.

Demographics.

	Fibromyalgia (*N* = 64)	Multiple sclerosis (*N* = 65)	Healthy adults (*N* = 86)	Combined sample (*N* = 215)
Age, mean (*SD*)	55.3 (14.5)	52.2 (13.0)	53.4 (19.9)	53.6 (16.4)
Sex (%)[a]				
Female	89.1	84.6	67.4	79.1
Male	10.9	15.4	32.6	20.9
Education (%)[a]				
Some high school	1.6	0.0	1.2	0.9
High school/GED	10.9	10.8	2.3	7.4
Vocational/technical school	7.8	4.6	1.2	4.2
Some college	34.4	23.1	22.1	26.1
College graduate	26.6	33.9	39.5	34.0
Graduate school or professional school	18.8	27.7	33.7	27.4
Race (%)				
White	79.7	81.3	82.4	81.2
Black/African American	9.4	10.9	9.4	9.9
Asian	1.2	3.1	2.3	2.3
More than one race	9.4	4.7	5.9	6.6
Ethnicity (%)				
Not Hispanic/Latino	87.3	95.3	95.4	93.0
Hispanic/Latino	3.2	1.6	3.5	2.8
No response	9.5	3.1	1.2	4.2
Marital status (%)[a]				
Married	42.2	69.2	38.4	48.8
Living with partner	9.4	3.1	7.0	6.5
In a relationship	1.6	0.0	7.0	3.3
Divorced/separated	12.5	15.4	18.6	15.8
Single, never married	25.0	7.7	24.4	19.5
Widowed	9.4	4.6	4.6	6.4

	Fibromyalgia (*N* = 64)	Multiple sclerosis (*N* = 65)	Healthy adults (*N* = 86)	Combined sample (*N* = 215)
Number of comorbid chronic conditions,[a,b] mean (*SD*)	2.3 (1.7)	1.1 (1.5)	1.1 (1.3)	1.4 (1.6)
Years since diagnosis, mean (*SD*)	11.6 (8.8)	13.8 (9.6)	-	12.7 (9.2)

SD: standard deviation; GED: general educational development.

[a]Indicates that groups differ ($p < 0.05$).

[b]Comorbid conditions include anemia, asthma, cancer, chronic fatigue syndrome, diabetes, heart disease, heart failure, hypertension, hyperthyroidism, kidney disease, liver disease, lung disease, lupus, post-polio syndrome, rheumatoid arthritis, and sleep apnea.

Table 2.

Descriptive data for the Pittsburgh Fatigability Scale (PFS).

	Cronbach's alpha (>0.70)	*SEM* percent (<10%)	Floor percent (<20%)	Ceiling percent (<20%)	Mean (*SD*)
Fibromyalgia					
PFS Physical	0.86	9.5	0.0	0.0	32.2 (8.2)
PFS Mental	0.85	16.5	1.6	0.0	24.4 (10.4)
Multiple sclerosis					
PFS Physical	0.85	10.7	0.0	1.6	30.4 (8.4)
PFS Mental	0.91	15.9	0.0	1.6	23.0 (12.2)
Healthy adults					
PFS Physical	0.88	20.9	2.4	0.0	15.2 (9.3)
PFS Mental	0.88	30.5	4.9	0.0	10.2 (9.0)
Combined sample					
PFS Physical	0.91	13.9	0.9	0.5	24.8 (11.8)
PFS Mental	0.91	20.4	2.4	0.5	18.4 (12.4)

SD: standard deviation; SEM: standard error of measurement.

Parentheses indicate reliability criterion.

Table 3.

Item-level reliability for the combined sample.

Item	Physical domain		Mental domain	
	Item-total correlation (⩾0.70)	**Cronbach's alpha "if item were deleted" (⩽0.91)**	**Item-total correlation (⩾0.70)**	**Cronbach's alpha "if item were deleted" (⩽0.91)**
Leisurely walk for 30 minutes	0.78	0.90	0.69	0.90
Brisk or fast walk for 1 hour	0.78	0.90	0.77	0.89
Light household activity for 1 hour (cleaning, cooking, dusting, straightening up, baking, making beds, dish washing, watering plants)	0.82	0.90	0.76	0.89
Heavy gardening or outdoor work for 1 hour (mowing (push), raking, weeding, planting, shoveling snow)	0.77	0.90	0.79	0.89
Watching TV for 2 hours	0.46	0.92	0.44	0.91
Sitting quietly for 1 hour	0.44	0.92	0.47	0.91
Moderate- to high-intensity strength training for 30 minutes (hand-held weights or machines greater than 5 lbs, push-ups)	0.70	0.91	0.81	0.89
Participating in a social activity for 1 hour (party, dinner, senior center, gathering with family/ friends, playing cards, bridge)	0.72	0.90	0.63	0.90
Hosting a social event for 1 hour (not including preparation time)	0.70	0.90	0.57	0.90
High-intensity activity for 30 minutes (jogging, hiking, biking, swimming, racquet sports, aerobic machines, dancing, Zumba)	0.69	0.91	0.77	0.89

Table 4.

Convergent and discriminant validity for the Pittsburgh Fatigability Scale (PFS).

	PROMISFatigue Experience	PROMIS Fatigue Social Impact	PROMIS Fatigue Cognitive Impact	PROMIS Fatigue Motivational Impact	Fatigue Severity Scale	PROMIS Physical Function	PROMIS Cognitive Function	Epworth Sleepiness Scale	PROMIS Sleep Disturbance	GAD-7 Anxiety	PHQ-8 Depression
PFS Physical	0.79	0.74	0.64	0.74	0.74	−0.81	−0.52	0.25	0.44	0.45	0.57
PFS Mental	0.67	0.63	0.60	0.64	0.55	−0.64	−0.48	0.23	0.44	0.49	0.53

PROMIS: Patient Reported Outcomes Measurement Information System; GAD-7: Generalized Anxiety Disorder 7-item scale; PHQ-8: Personal Health Questionnaire Depression Scale.

All values of $p < 0.0001$.

Table 5.

Known group validity for the Pittsburgh Fatigability Scale (PFS).

	Fibromyalgia *M* (*SE*)	**Multiple sclerosis *M* (*SE*)**	**Healthy adults *M* (*SE*)**	***F* value**	**ηp^2**	***p* value**
PFS Physical[a,b]	30.57 (1.49)	28.24 (1.30)	14.70 (0.97)	62.35	0.44	<0.0001
PFS Mental[a,b]	22.84 (1.74)	20.57 (1.53)	9.96 (1.15)	28.12	0.27	<0.0001

SE: standard error; PFS: Pittsburgh Fatigability Scale.

Marginal means and standard errors are presented, adjusting for gender and age of participants; *F* value and *p* value are based on the type III sum of squares for the group variable; ηp2 = partial eta-squared effect size.

[a]Fibromyalgia differs in healthy adults.

[b]Multiple sclerosis differs in healthy adults.